Hanford Ground-Water Data Base Management Guide and User's Manual

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PREFACE

This document is divided into two main parts. Part I is a management guide for data base maintenance. This includes all data entry and modification activities. Part II is the user's manual for all data retrieval activities. Appendix C, which is not referred to in the body of the text, describes a separate data base for ground water modeling which will contain artificial recharge rates to the ground from Hanford Site disposal activities.

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SUMMARY

This management guide and user's manual is a working document for the computerized Hanford Ground-Water Data Base maintained by the Geosciences Research and Engineering Department at Pacific Northwest Laboratory for the Hanford Ground-Water Surveillance Program. The program is managed by the Occupational and Environmental Protection Department for the U.S. Department of Energy. The data base is maintained to provide rapid access to data that are routinely collected from ground-water monitoring wells at the Hanford site. The data include water levels, sample analyses, geologic descriptions and well construction information for over 3000 existing or destroyed wells. These data are used to monitor water quality and for the evaluation of ground-water flow and pollutant transport problems.

The management guide gives instructions for maintenance of the data base on the Digital Equipment Corporation PDP 11/70 Computer using the CIRMIS (Comprehensive Information Retrieval and Model Input Sequence) data base management software developed at Pacific Northwest Laboratory. Maintenance activities include inserting, modifying and deleting data, making back-up copies of the data base, and generating tables for annual monitoring reports.

The user's guide includes instructions for running programs to retrieve the data in the form of listings or graphical plots.

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PART I. MANAGEMENT GUIDE

1.0 INTRODUCTION

CIRMIS (Comprehensive Information Retrieval and Model Input Sequence) is a data base management system developed at Pacific Northwest Laboratory (PNL) by Dennis Friedrichs in 1974. The software was written to store and retrieve ground-water monitoring-well water level measurements, sample analytical data and other types of information for the Hanford site in eastern Washington (Friedrichs and Argo 1980). The PNL data base employing CIRMIS is called the Hanford Groundwater Data Base. CIRMIS is the tool, or set of computer programs, used to input and retrieve data from the data base. The programs of CIRMIS, therefore, define the way the data base is organized and the way data are input and retrieved.

CIRMIS stores data in direct access files (developed for the Digital Equipment Corporation PDP 11/70 computer) called "File-Q" files. "Blocks" of data are stored or retrieved for one well at a time, each "block" containing 256 integer or 128 real values. In order to store or retrieve data from the data base, the location in each file the desired block of data must be known. The files are called "direct access" because blocks in the files can be accessed directly when the block number is known. This differs from "sequential" files whose data can only be accessed in numerical sequence. Retrieval of data from direct access files is faster than from sequential files when the desired data are scattered throughout the file, as is the case with large data bases.

Some of the terms used in this report are briefly defined here:

File-Q file	= random or direct access file
1 character	= 1 byte
1 byte	= 8 bits
1 integer word	= 2 bytes
1 real word	= 2 integer words
1 disc sector	= 256 integer words = 1 block.

CIRMIS stores data in a hierarchical fashion by well and then by type of data (water level, analytical, etc.). In other words, to store or retrieve data, the user must input the well name and type of data desired for that

well. Given the well name, CIRMIS reads "header" information for that well from a File-Q file called WELLHDR. WELLHDR is also a directory of which data types are available for each well and where the data are located. Having read the header information from WELLHDR and having found where the desired data are located, CIRMIS goes to the appropriate file to store or retrieve the data contained at the file location specified in WELLHDR.

"Header" information for a given well can be found only when it is known where in WELLHDR to look, since WELLHDR is a direct access file. To aid in locating desired information in WELLHDR, a File-Q "look-up" file for wells, called WELLNAM was created. WELLNAM contains a list of all well names, the location of each name in the list corresponding with the block number at which information in WELLHDR can be found for that well. Therefore, the paths to data are through WELLNAM, then through WELLHDR, and then to the appropriate data files. For example, to find hydrograph information for Well 6 20 20, CIRMIS finds "6 20 20" in the WELLNAM file and reads data from the same location in WELLHDR. If the data exists, it is then found in a file called FRMTHYD (the direct access file containing hydrograph data).

2.0 HEADER INFORMATION ON WELLS

The CIRMIS system is suited for use with ground-water data that are based on wells. The WELLNAM and WELLHDR File-Q files are created with the program WHDRGEN. WHDRGEN reads the wells in sequential order from a formatted file called WELHDR.FOR and stores the well names in the direct access file WELLNAM. Each well's header parameters are then stored in another direct access file, WELLHDR, which contains a 256 integer-word disk sector for each well.

The direct access file CTMHDR, which is generated by WHDRGEN, contains addresses for all the sample analytical data for each well. The addresses indicate where analytical data are located in the FRMTCTM direct access file for a given well. The CTMHDR file was developed because the WELLHDR file is not large enough to store all available addresses for analytical data.

The direct access file UPDATEHDR is generated by WHDRGEN. This file is a single block long and contains information on the starting location for adding contaminant, hydrograph, temperature, and well log data to existing files. WHDRGEN also creates a formatted file called WELHDRNEW.SEQ. This file contains a listing of well names with associated block addresses in WELLHDR. WELHDRNEW.SEQ is used when all wells in the data base are to be searched for information because it provides a rapid access to the WELLHDR file. Examples of programs using WELHDRNEW.SEQ (or a subset of it) are CRMFOR (See Section 5.2.3), APPENA, and APPENB (described in Section 3.0 of Part II.)

2.1 FORMAT OF WELHDR.FOR

The WELHDR.FOR file is created using the system editor. It contains a list of well names with location coordinates and casing elevations.

A brief example is shown below:

WELHDR.FOR

```
1 B3 1 PN 71800. W 79830. 439.79
6 24 24 PN 50000. W 2000. 442.0 HAN6 24
```

The first line of the file is read but ignored, so it can contain the name of the file or some other descriptive phrase.

The format of WELHDR.FOR is:

<u>Current Well Name</u>	<u>Real Coordinates</u> <u>(X) (Y)</u>		<u>Casing Elevation</u>	<u>Changed Well Name</u>	<u>Previous Well Name</u>
1X 12A1	1X,2A1,F8.0	A1,F7.0	F8.2	5X,12A1	5X,12A1

Normally the well name, coordinates, and casing elevation are known from regional documentation. In most cases, the coordinates (which may be in the form of township and range, latitude and longitude, or even in some local coordinate system) must be converted to Plant, Richland, or Hanford coordinates that are stored in the data base. The coordinates in the regional documentation are converted to Plant coordinates with the CONVRT program (see Section 2.3).

2.2 PROGRAM WELCOMPAR FOR UPDATING WELHDR.FOR

Information for WELHDR.FOR on coordinates and casing elevations for new or existing wells and name changes for wells are received from Hanford field personnel. A formatted file called DCUMNT.DAT is a master file of all Hanford site wells constructed from pre-Hanford Works days to the present. Upon request, DCUMNT.DAT is used as input to the program WELDOC to create DCUMNT.LST, which is in a readable table-format for inclusion in the Hanford Wells Book document. (DCUMNT.DAT and DCUMNT.LST are renamed (e.g., DCUMNT84) and stored on tape each time they are updated.)

Program WELCOMPAR is run to show the differences between DCUMNT.DAT and WELHDR.FOR so that both files are as complete as possible. Occasionally, new wells will be added to WELHDR.FOR when hydrograph or analytical data are received before the well appears in DCUMNT.DAT. As a rule, all data on wells in DCUMNT.DAT supersede those in WELHDR.FOR. WELCOMPAR compares well names, coordinates, and casing elevations in DCUMNT.DAT with WELHDR.FOR and lists unmatched wells in the output file UNMATCHED.DAT. The list of wells in WELHDR.FOR should be in the same order as the wells in DCUMNT.DAT. (If they are not in the same order, some wells that are in both files will be listed in the UNMATCHED.DAT file). All unmatched wells should be examined and, when possible, WELHDR.FOR should be changed to agree with DCUMNT.DAT. However,

DCUMNT.DAT should never be changed to agree with WELHDR.FOR because coordinates and casing elevations may have been estimated for WELHDR.FOR before survey data were available.

2.3 PROGRAM CONVRT FOR COORDINATE CONVERSION

The CONVRT program can be used to convert 1) Lambert coordinates to Plant coordinates, or 2) Plant, Hanford, and Richland coordinates to Lambert (State) coordinates and longitude-latitude values.

1) Example input file of Lambert coordinates to be converted to Plant coordinates:

```
6 111 24    516240.03N 2271040.00E
6 113 38    518204.09N 2257035.25E
6 114 60    519147.59N 2235032.50E
6 HAN  1    458165.88N 2281948.25E
6 HAN  2    457473.84N 2281546.00E
```

Format: 1X,12A1,1X,F10.0,A1,1X,F10.0,A1

The following is the interactive stream for running CONVRT (user responses are underlined):

```
PDS >>RUN DB1:CONVRT
ENTER NAME OF INPUT FILE (30A1) > COORDS.INP
ENTER NAME OF OUTPUT FILE (30A1) > COORDS.OUT
SELECT:
(0) Lambert to Plant coordinates
(1) Plant, etc. coordinates to Lambert to Longitude-Latitude
0
TT00A -- STOP
```

The output file for the above example is:

WELL		LAMBERT COORDINATES		PLANT COORDINATES	
6	111 24	516240.N	2271040.E	111000.N	24000.W
6	113 38	518204.N	2257035.E	113000.N	38000.W
6	114 60	519148.N	2235033.E	114000.N	60000.W
6	HAN 1	458166.N	2281948.E	52898.N	13241.W
6	HAN 2	457474.N	2281546.E	52207.N	13645.W

2) Example input file of Plant coordinates to be converted to Lambert coordinates:

```

6 111 24  PN 111000.W 24000.  699.14
6 113 38  PN 113000.W 38000.  732.01
6 114 60  PN 114000.W 60000.  787.50
6 HAN  1  PN  52898.W 13241.  392.82
6 HAN  2  PN  52207.W 13645.  394.97

```

Note: the P must be replaced with a H or R for Hanford or Richland coordinates, respectively).

FORMAT: 1X,12A1,1X,A1,A1,F7.0,1X,A1,F7.0,F8.0

The interactive stream for running the other option in CONVRT is:

```

PDS>> RUN DB1:CONVRT
ENTER NAME OF INPUT FILE (30A1) > DB1:COORDS.INP
ENTER NAME OF OUTPUT FILE (30A1) > DB1:COORDS.OUT
SELECT:
(0) LAMBERT TO PLANT COORDINATES
(1) PLANT, ETC. COORDINATES TO LAMBERT TO LONGITUDE-LATITUDE
  1
TT00A -- STOP

```

The output file for the above example is:

WELL NAME	PLANT COORDINATES	LAMBERT COORDINATES	LONGITUDE	LATITUDE
6 111 24	PN111000. W 24000. LN 516240.03 E 2271040.00	119. 25. 7.86	46. 44. 38.03	
6 113 38	PN113000. W 38000. LN 518204.09 E 2257035.25	119. 28. 28.58	46. 44. 59.29	
6 114 60	PN114000. W 60000. LN 519147.59 E 2235032.50	119. 33. 44.38	46. 45. 0.00	
6 HAN 1	PN 52898. W 13241. LN 458165.88 E 2281948.25	119. 22. 43.10	46. 35. 3.32	
6 HAN 2	PN 52207. W 13645. LN 457473.84 E 2281546.00	119 22. 49.00	46. 34. 56.54	

3.0 ADDING WELLS WITH PROGRAM WHDRADD AND EMAGEN

The "Changed Well Name" and "Previous Well Name" fields of WELHDR.FOR (described in Section 2.1) are not used by WHDRGEN, but are used by WHDRADD. The WHDRADD program adds new wells to the data base while maintaining the existing wells and associated data. WHDRADD requires use of the input file WELHDR.FOR and a mounted "backup" disk in addition to the original disk containing the data base. WHDRADD is run interactively so that disk numbers can be entered accordingly. This process updates the WELHDR, WELNAM, UPDATEHDR, and CTMHDR direct access files on the backup disk. At this point the backup disk requires the remainder of data base direct access files, EMACODE, FRMTHYD, FRMTTMP, FRMTWST, FRMTWLG, FRMTVTT, FRMTCTM, GRADX, GRADY, WELL299E, WELL299W, WELL699, WELL399, to be a complete copy of the data base. Furthermore, the updated WELHDR, WELNAM, PDATEHDR and CTMHDR files must be copied back to the original disk to include the added wells.

WHDRADD creates a new file called WELHDRUPD.FOR which now contains the old well name in the "Previous Well Name" field, and leaves the "Changed Well Name" field blank. After new wells have been added, or old well names changed, the WELHDRUPD.FOR file should be renamed WELHDR.FOR, for input to a subsequent run of WHDRADD or WELCOMPAR.

EMAGEN must also be run when the new wells added to WELHDR.FOR are those which will receive analytical or temperature data identified by well EMA (Environmental Monitoring Analysis) code (an alternate well designation system used for Hanford wells). A file called EMACODE.SRC must be updated and input to program EMAGEN. Each record of this file contains a Hanford well designation in columns 3-14 (6A2) and its corresponding EMA code in columns 20-23 (I4). The records are arranged in ascending order by EMA code. EMAGEN packs these records (32 to a disk sector) and outputs them to the FILE-Q structured file EMACODE. It is this file that the CRMSD subroutines use in converting from EMA code to the Hanford well designation assigned to the well in the field.

4.0 ORGANIZATION OF WELLNAM DIRECT ACCESS FILE

In order to access data for a given well, that well's name must first be located in WELLNAM. WELLNAM, like WELLHDR, is a direct access file from which data are retrieved a block at a time. Each block retrieved from WELLNAM contains 512 bytes or characters. The names of all the wells in the data base are stored in WELLNAM, 42 names per block. This is because the type of well designations used on the Hanford site, for which CIRMIS was initially designed, requires 12 characters per well designation. With such designations, only 42 well names can be stored in a 512-byte block ($12 \times 42 = 504$ characters with 8 bytes left over at the end of the block).

Hanford well designations usually indicate the particular area in which the wells are located. The areas are called 199, 299E, 299W, 399, 499, 699, 1199, and 3099. The first two characters of the Hanford well name indicate in which of these areas the well is located. The corresponding first two characters of Hanford well names are 1, 2E, 2W, 3, 4, 6, 11, and 30. Retrieval efficiency over a random listing of well names is improved because the wells are grouped in WELLNAM according to the area in which the well is located. A set number of blocks are allocated for each area and the number of blocks depend on the current and expected number of wells drilled in that area. therefore, retrieval of data for a well in a specific area only requires a search in the correct group of blocks.

Table 1 shows the current storage allocations for the data base. The first two characters of the well names (Well Prefix) indicates the areas in which the wells are located. The block range shows which blocks are allocated in WELLNAM for each area. The number of blocks allocated for each area (No. of Blocks) and the current number of well names stored for each area (Wells Stored) are also shown. As of September 1984, and the maximum number of well names that can be stored, given the number of blocks allocated for each area, is listed (Max. No. of Wells).

TABLE 1. Hanford Ground-Water Data Base Storage Allocation

<u>Well Prefix</u>	<u>Block Range</u>	<u>No. of Blocks</u>	<u>Wells Stored</u>	<u>Max. No. of Wells</u>
1	0 to 4	5	105	210
2E	5 to 34	30	555	1,260
2W	35 to 69	35	801	1,470
3	70 to 74	5	37	210
6	75 to 124	50	781	2,100
11	125 to 129	5	105	210
30	130 to 131	2	9	84
4	132 to 134	<u>3</u>	<u>3</u>	<u>126</u>
	Totals	135	2,396	5,670

These well prefixes, which have matching starting blocks in WELLHDR, are programmed into the generator programs WHDRGEN and WHDRADD, and the retrieval subroutine RTVHDR. RTVHDR is the subroutine used by all the programs accessing the data base. WHDRGEN and WHDRADD store the well names of a given area sequentially in the blocks allocated for that area. When data for a given well are requested, RTVHDR starts at the starting block of the appropriate area and searches sequentially through each block of WELLNAM until the desired well name is found or the end of the group of blocks allocated for that area is encountered. If the desired well name is not found, a message is written to the screen during use of the retrieval programs.

5.0 ROUTINE DATA BASE MAINTENANCE PROGRAMS

Normally, only two programs are run on a regular basis to check input data and insert, modify or delete data. These are SCREEN and CRMSED. Basically, SCREEN is used to check new analytical data for possible "outliers" (bad or inconsistent values) or other problems prior to entering the data into the data base. SCREEN also predicts when a given constituent is expected to exceed maximum permissible limits or drop below minimum detection limits according to the historical trend in values. CRMSED is the program used to enter, delete, or change data in the data base, which includes sample analytical, hydrograph (ground-water elevations), and temperature data. (Sections 5.3 and 5.4 describe input and modification of geologic and well construction data, respectively).

5.1 CHECKING NEW ANALYTICAL DATA FOR OUTLIERS AND TRENDS (SCREEN)

SCREEN is run to check water quality input data for possible "outliers", or new data points that are not consistent with the trend of the previous five years of measurements. SCREEN also compares the trend in the measured data with the U.S. Department of Energy (DOE) or the U.S. Environmental Protection Agency (EPA) maximum permissible limits to estimate when concentrations at a given well will exceed water quality standards or drop below laboratory detection limits.

Prior to running SCREEN on data files received from the laboratory an "INSERT" line must be added to the beginning of the data file and an "END" line added to the end. These additional lines, which serve as control records for CRMSED, are more fully explained in Section 5.2.

A sample input file is shown below:

```
INSERT 1 1 830302
KI1882 108830302      0.14E+05 0.00E+000.00E+00
KI1882 115830302      0.46E+01 0.00E+000.00E+00
KI1884 108830302      0.49E+05 0.00E+000.00E+00
END
```

This simplified input file does not show data in fields which are not read by SCREEN, although they are pertinent to the laboratory.

The first line, "INSERT", is read, and only IOTYPE (see Section 5.2.1) is used by SCREEN. The last line, "END", indicates the end of the data set. The lines in between, containing actual data supplied by the laboratories, are described in detail in Section 5.2.2. The following is the interactive stream for running SCREEN (responses by the user are underlined):

```
RUN DB1:SCREEN
ENTER FILE-Q DISC UNIT (IE. DP1,DB0) > DB1:
ENTER CRITERIA FILE (30A1) > CRIT.DOE
ENTER INPUT FILE (30A1) > DB1:UST840113.INP
SELECT:
(<CR>) REGULAR INPUT ANALYSIS
(1) ANALYZE LAST 20 PTS PRIOR TO GIVEN DATE
<cr>
TTOOA  --  STOP
```

The output file, SCREEN.OUT, gives information on the input data. A new data point is considered an "outlier" if it lies outside the two-sigma envelope of a predicted value for that date. The prediction is made by fitting a straight line through the logarithms of the last 20 points of data for that particular constituent and well. The logarithm of the data values are not used for fitting if any of the last 20 points are zero or negative. The envelope is calculated as 2.09 times the standard deviation of the prediction, corresponding to the 95% confidence interval for a "student's T" distribution with 20 degrees of freedom. Information on "outliers," or the dates (in YYMMDD format) when maximum permissible or minimum detection limits are expected to be reached, is written to SCREEN.OUT. If a limit is expected to be exceeded after December 31, 1999, the date is written as 991231+. SCREEN.OUT contains the well EMA number, the Hanford well designation, the sample date, the name of the constituent, the constituent EMA number, the Hanford constituent number, the lab measured value for concentration or activity, the minimum detection limit (read from a file such as CRIT.DOE or CRIT.EPA containing DOE and EPA standards, respectively), a "YES" or "NO" indicating whether or not the level

was less than the detection limit, the upper limit of concentration or activity allowed for that constituent by DOE or EPA, a "YES" or "NO" indicating whether the contaminant level exceeded that limit, and the date the concentration or activity is expected to drop below the detection limit or exceed the maximum permissible limit.

5.2 INSERTING, MODIFYING AND DELETING ANALYTICAL, HYDROGRAPH AND TEMPERATURE DATA WITH THE PROGRAM CRMSED

CRMSED provides generating and updating capabilities for the CIRMIS data base direct access files of analytical, hydrograph, or temperature data. The program provides a means for entering new data, deleting incorrect data, and modifying selected data points. The code was written in modular form to facilitate the addition of new data types. Because of the overlay structure, the routines share the same memory, and currently require less than 100K of memory to execute. CRMSED initially generates the data base. Regeneration programs are used to restore the data files, if necessary (CRMSED subroutines and regeneration programs are described in Appendix B).

The files used and created by CRMSED are:

<u>Name</u>	<u>Type</u>	<u>Access</u>
FILE Q--WELLNAM	RANDOM	READ
FILE Q--WELLHDR	RANDOM	READ/WRITE
FILE Q--UPDATEHDR	RANDOM	READ/WRITE
FILE Q--EMACODE	RANDOM	READ
FILE Q--FRMTHYD (HYDROGRAPH DATA FILE)	RANDOM	READ/WRITE
FILE Q--FRMTTMP (TEMPERATURE DATA FILE)	RANDOM	READ/WRITE
FILE Q--FRMTCTM (ANALYTICAL DATA FILE)	RANDOM	READ/WRITE
FILE Q--CTMHDR (ANALYTICAL HEADER FILE)	RANDOM	READ/WRITE
CRMSED.INP	FORMATTED	READ
CRMSED.RUN	FORMATTED	WRITE

The file UPDATEHDR stores the addresses of the next available free sectors of the hydrograph, temperature, and geologic log files so that data can be added to these files. Analytical and temperature data are usually received in

the correct format on magnetic tape. Hydrograph data, however, requires some processing because it is not usually received in the required feet above mean sea level. Programs for converting data from meters to feet, or from depth to water to feet above sea level, are described in Example 5 of Section 5.2.2.

An input file called CRMSD.INP, for example, must be available to run CRMSD. Files are actually named UST840101.INP or BNW840101.INP to indicate 1) whether the data are from Pacific Northwest Laboratory or U.S. Testing Laboratory and 2) the date of processing with CRMSD. The data file consists of one or more data sets. A data set contains a control record (see Section 5.2.1), data records (described in Section 5.2.2), and an END card ("END" in columns 1-3). The control record describes the action to be taken on the data (INSERT, CHANGE, or DELETE), the data type (hydrograph, analytical or temperature), and the form of the data (Hanford designations or EMA codes for wells and constituents). It also contains the current date for descriptive purposes and for checking by CRMSD to ensure that no dates in the input data are later than the current date. Any number of data sets may follow one another in the same CRMSD.INP file. Each data set must be set apart, however, with its own control record and END card.

The current CIRMIS FILE-Q data base disc must be mounted (although it is usually mounted) on the appropriate disc drive after logging into the PDP 11/70 computer as follows (all user responses are underlined and (cr) means carriage return):

```
PDS>> LOGIN CIRMIS (Password)
PDS>> MOU DB1:SPLITV/CHA=[DCF,ATCH]
MDUNT - ** VOLUME INFORMATION
        DEVICE  = DB1:
        CLASS   = FILE 11
        LABEL   = SPLITV
        UIC     = [1,1]
        ACCESS  = [RWED,RWED,RWED,RWED]
        CHARAC  = [DCF,ATCH]
PDS>> RUN DB1:CRMSD
ENTER FILE-Q DISC (I.E. DB2 or DB1) DB1
```

ENTER NAME OF INPUT FILE

DB1:CRMSED.INP

*****CRMSED FINISHED*****

CRMSED reads the data from the indicated input file (CRMSED.INP in this case), locates the appropriate file on the FILE-Q disc, performs the task indicated on the control card (INSERT, DELETE, OR CHANGE) if possible, then writes the card image from CRMSED.INP to a formatted file CRMSED.RUN. If it was not possible to perform the task (well not found, EMA code not found, etc.) an error message is also written to CRMSED.RUN. When CRMSED is finished, the file CRMSED.RUN must be listed on the printer and examined for error messages. Errors, if any, must be corrected in a new file, and CRMSED must be rerun. When a successful run has been made, the input and output files are copied to tape and stored with a directory listing of the tape.

5.2.1 Control Record Format

The first line of each input data set is a control record that indicates the action to be taken (INSERT, DELETE, or CHANGE), the type of data (hydrograph, analytical or temperature), and the form of the well names and constituent codes (Hanford designations or EMA codes). The following are some examples of control records, an explanation of the different parts of the control record, and the control record format.

Control Record Examples:

INSERT 1 1 840210

DELETE 1 0 840210

CHANGE 0 0 840210

Control Card Format: (A6, 1X, I1, 1X, I1, 1X, F6.0)

Control Record Explanation:

Columns 1-6 (A6) Update Action:

INSERT : Insert new data to existing data files.

DELETE : Delete the following data from existing data files.

CHANGE : The following data are to replace existing data in the files.

Column 8 (I1)

IDTYPE : Indicates the type of data to be acted upon.

Currently IDTYPE can take on three values:

- = 0 : hydrograph (ground water elevation data)
- = 1 : analytical data
- = 2 : temperature data

Column 10 (I1)

IDTYPE : Indicates the type of well and analysis designations (used only for analytical and temperature data).

= 0 : Hanford designations will be used in the data set:

(e.g., 2W 23 1 for a well,
1 through 32 for contaminants)

= 1 : EMA codes:

(e.g., 1300 designating the Hanford well 2W 23 1,
115 designating the constituent nitrate).

Columns 12-17 (F6.0) Current Date: Used to check input dates (to be certain they do not exceed the current date) and to record the date of processing within the file.

The Hanford well designations and corresponding EMA codes for wells can be found in the file EMACODE.SRC. The Hanford designations and corresponding EMA codes for constituents are listed below:

<u>Hanford Constituent No.</u>	<u>Constituent Name</u>	<u>EMA Code for Constituent</u>
1 --	TOTAL ALPHA	112
2	TOTAL BETA	111
3 --	TRITIUM	108
4	NITRATE	115
5 --	STRONTIUM-90	121
6	CESIUM-137	24
7 --	COBALT-60	10
8	URANIUM-238	104
9 --	PLUTONIUM-239	103
10	RUTHENIUM-106	34

11	--	CHROMIUM +6	114
12		FLUORIDE	26
13	--	MAGNESIUM	54
14		PU 239/240	100
15	--	PU 238	102
16		CHLORIDE	57
17	--	COPPER	58
18		HARDNESS	62
19	--	SOLIDS	63
20		NITRATE ION	116
21	--	TOTAL ORGANIC	
		CARBON	198
22		PH	199
23	--	SULFATE	200
24		SODIUM	201
25	--	CALCIUM	202
26		TOTAL GAMMA	998
27	--	BICARBONATE ION	188
28		CARBONATE ION	189
29	--	TOTAL POTASSIUM	190
30		SPECIFIC	
		CONDUCTIVITY	191
31	--	BORON	192
32		LOW ALPHA	212

5.2.2 Data Record Format

This section illustrates the possible types of data records for CRMSED.

The examples given in this section are summarized here:

Example 1: Insert Analytical Data (EMA Codes for Well Names
and Constituents)

Example 2: Insert Analytical Data (Hanford Well Designations)

Example 3: Modify Analytical Data (Hanford Well Designations)

- Example 4: Delete Analytical Data (Hanford Well Designations)
- Example 5: Insert Hydrograph Data (Hanford Well Designations)
- Example 6: Modify Hydrograph Data (Hanford Well Designations)
- Example 7: Delete Hydrograph Data (Hanford Well Designations)
- Example 8: Insert Temperature Data (Ema Codes or Hanford Well Designations)
- Example 9: Modify Temperature Data (Ema Codes or Hanford Well Designations)
- Example 10: Delete Hydrograph Data (Ema Codes or Hanford Well Designations)

Example 1. Insert Analytical Data (EMA Codes for Well Names and Constituents)

```

INSERT 1 1 831230
UI4874012183120912008312091200 1.11E+00*1.20E+011.21E+010.10
UM4875012183120912008312091200-4.74E+00*7.91E+007.94E+000.10
U02372012183120912008312091200-8.40E+00*8.80E+008.90E+000.10
UI2511010483111512008311151200 1.59E+01 5.36E+000.00E+000.01
END

```

Data Record Format (1X,A1,I4,I1,I3,F6.0,14X,E9.2,1X,2E8.2)

Data Record Explanation:

An explanation of these lines, by column number, is summarized below and described in the following text. (Data fields containing values from the laboratory, but not used or stored by the data base, are not described here.)

Column 1: The Lab Code indicates which laboratory did the analysis. "U" represents the U.S. Testing Laboratory, "K" represents Pacific Northwest Laboratory and "H" represents the laboratory at the HEHF (Hanford Environmental Health Foundation). This information is not stored in the data base.

<u>Column #</u>	<u>Description</u>
1	Lab Code
2	Update Action
3-6	EMA Code
8-10	EMA Code for Constituent
11-16	Sample Date (YYMMDD)
31-39	Measured Value
40	Less Than Flag
41-48	Counting Error (for radionuclides only)
49-56	Total Propagated Error

Column 2: The Update Action indicates the type of action to be taken on the data. The three indicators received, in order of decreasing frequency of occurrence, are :

- 1) "I" for insert
- 2) "M" for modification or change, and
- 3) "D" for deletion of the data point.

Although this value is not stored in the data base, SCREEN warns the user if the update action is other than an "I." Different data record formats are required for deletions or modifications.

Columns 3-6 (I4): The EMA Code indicates the well for which the analysis is made. Each EMA Number corresponds to a Hanford well designation. A typical Hanford well designation is 6 24 1, indicating a well in the 600 Area. The approximate Plant Coordinates are 24,000 feet west and 1000 feet north of the Hanford origin. A sequential listing of EMA numbers with the corresponding Hanford well designations is contained the file EMACODE.SRC.

Columns 8-10 (I3): The Constituent Code is an EMA code for the constituent type. EMA numbers for the 32 constituents are scattered between 10 and 998. CIRMIS converts EMA codes to numbers from 1 to 32 for efficiency. A listing of CIRMIS constituent codes with corresponding EMA numbers is presented in Section 5.2.1.

Columns 11-16 (F6.0): The Sample Date is the date the sample was taken in the field. The date is in YYMMDD format, with the year designated first, the

month second, and the day last, using two numbers for each. For example, June 2, 1984, would be designated 840602. November 11, 1911, would appear as 111111.

Columns 31-39 (E9.2): The measured value represents the concentration or activity (for radionuclides) of the contaminant as measured by the laboratory. Concentrations are reported in milligrams per liter and activities are reported in pico-curies per liter. The activity values are calculated at U.S. Testing from this equation:

$$A = \frac{S-B}{E*Y}$$

where A is the sample activity in disintegrations per minute (dpm), S is the sample count rate (cpm), B the background count rate (cpm), E the counter efficiency in counts per disintegration, and Y the procedure recovery (yield). The laboratory converts A to pico-curies per liter for each radionuclide. The elements of the calculation are more fully explained in the internal document distributed by U.S. Testing entitled "Transmission of Error for Radiochemical Analyses." The sample count rate, S, in the above equation may be smaller than B, the background count rate, and, therefore, the activity is calculated as a negative value. Negative values occur fairly frequently in the analyses sent by the laboratory and are inserted as such.

Column 40: The Less Than Flag in column 40 is not currently stored in the data base.

Columns 41-48 (E8.2): This field contains the Counting Error for radionuclide analyses. According to page 2 of the U.S. Testing internal document, "Transmission of Error for Radiochemical Analysis," the estimated error in radioactive counting is given by the standard deviation of the count rate, defined as "assuming a Poisson distribution, ... the square root of the count rate divided by counting time." The counting error, then, is given by:

$$E = (cpm/t)**0.5,$$

where E is the counting error, cpm is the sample count rate, and T is the counting period.

Columns 49-56 (E8.2): The Total Propagated Error is the sum of all the errors involved in the analysis.

Example 2. Insert Analytical Data (Hanford Designations for Well Names and Constituents)

```
INSERT 1 0 840210
6 42 40A 5831209 1.11E+00 1.20E+01 1.21E+01 0
END
```

Data Record Format (12A1,1X,I2,F6.0,3E10.2,I5)

Data Record Explanation:

<u>Column #</u>	<u>Example Value</u>	<u>Description</u>
1-12	6 42 40A	Hanford Well Designation
14-15	5	Hanford Constituent Number
16-21	831209	Date sample was taken
22-31	1.11E+00	Analytical value
32-41	1.20E+01	Counting error
42-51	1.21E+01	Total propagated error
52-56	0	Duplicate number

Example 3. Modify Analytical Values (Hanford Designations for Well Names and Constituents)

```
CHANGE 1 0 841001
6 42 40A 5831209
1.11E+00 1.20E+01 1.21E+01 0 2.22E+00 2.40E+01 2.42E+01 0
END
```

Data Record Format(12A1,1X,I2,1X,F6.0 / 2(3E10.2,I5))

Data Record Explanation :

Line 1 : CHANGE card (Described in section 5.2.1.)

Line 2 : Well designation (6 42 40A), constituent number
(5 corresponds to strontium-90), sample date
(831209 is December 9, 1983).

Line 3 : Existing data followed by new values desired.

1.11E+00 = existing analytical value
1.20E+01 = existing counting error
1.21E+01 = existing total propagated error
0 = existing duplicate number (always 0)

2.22E+00 = new analytical value
2.40E+01 = new counting error
2.42E+01 = new total propagated error
0 = new duplicate number (always 0)

Line 4 : END indicates end of data set

Example 4. Delete Analytical Values (Hanford Designations for Well Names and
Constituents)

```
DELETE 1 0 841001
6 42 40A 5831209 1.11E+00 1.20E+01 1.21E+01
END
```

Data Record Format (12A1,1X,I2,F6.0,3E10.3,I5)

Data Record Explanation:

6 42 40A : Hanford Well Designation.
5 : Constituent Number
831209 : Sample Date
1.11E+00 : Analytical Value
1.21E+01 : Counting Error
1.20E+01 : Total Propagated Error

Example 5. Insert Hydrograph Data (Hanford Designations for Well Names)

Special Preparation for Data Received as Meters Above Mean Sea Level
(HYDCON)

Water level data for selected wells are received from Rockwell Hanford Operations in a published table twice per year in the form of meters above mean sea level. These values must be converted to feet above mean sea level with the program HYDCON. An input file for all wells in the table must be prepared, as shown below, in an example for one data point:

6 59 56 830503 27.96

Data Record Format (12A1,1X,6A1,F10.0)

Data Record Explanation:

6 59 56 : Hanford Well Designation
830503 : Date of Measurement (usually at top of data sheet)
27.96 : Water Level in Meters above Mean Sea Level

The program may be run as follows when the input file has been created:

PDS>>RUN DB1:HYDCON
ENTER NAME OF HYDROGRAPH INPUT FILE

DB1:HYDMETER.DAT

OUTPUT FILE WILL BE DB1:HYDMETER.FET

CONVERT:

(1) METERS TO FEET

(2) FEET TO METERS (not used for input to this data base)

1

The output file is in the correct format to use with CRMSED for input to the data base, except that a control card must be added to the top of the file (See Section 5.2.1) and an END card must be added to the end of file. The .DAT, .INP, and .RUN (created by CRMSED) files are then copied to tape and the line printer listings of these files are put into a notebook designated for hydrograph data. MNTR is run to check that the data were successfully added to the data base (see Section 2.0 of Part II).

Special Preparation for Data Received as Depths to Water (HYDCOR)

Depth to water table measurements in feet are received from Basalt Waste Isolation Program (BWIP) monitoring activities. Depth to water values must be converted to feet above mean sea level by subtracting them from the associated casing elevations for each well as stored in the file WELHDR.FOR. The HYDCOR program performs this task when used as shown below. An example input file called HYD841001.DAT (use current date in the filename) is shown below for one well:

6 42 12A 841001 163.03

Data Record Format (12A1,1X,F6.0,F10.0)

Data Record Explanation:

6 42 12A : Hanford Well Designation
841001 : Date of Measurement
163.03 : Depth to Water in Feet

The program is run as follows:

```
PDS>>RUN DB1:HYDCOR
ENTER NAME OF FILE TO BE CONVERTED HYD841001.DAT
YOUR OUTPUT FILE IS HYD841001.INP (INPUT FILE TO CRMSED)
TT16 -- STDP
```

The output file is in the correct format to use with CRMSED for input to the data base, except that a control card must be added to the top of the file (See Section 5.2.1) and an END card must be added to the end of file. The .DAT, .INP, and .RUN files (created by CRMSED) are then copied to tape and the line printer listings of these files are put into a notebook designated for hydrograph data. MNTR is run to check that the data were successfully added to the data base (see Section 2.0 of Part II).

Files of water level data created from scratch (i.e., not created by running HYDCON or HYDCOR) must be in the following format:

```
INSERT 0 0 841001
  6  42 12A   830601   374.51
END
```

Data Record Format (12A1,1X,F6.0,F10.0)

Data Record Explanation:

```
6  42 12A : Hanford Well Designation.
      830601 : Date of Measurement
      374.51 : Water Level measurement above Mean Sea Level in Feet.
```

Example 6. Modify Hydrograph Data (Hanford Designation for Well Names)

```
CHANGE 0 0 841001
  6  42 12A   830601   364.51   374.51
END
```

Data Record Format (12A1,1X,F6.0,2F10.0)

Data Record Explanation:

```
  6  42 12A : Hanford Well Designation
      830601 : Date of Original Measurement
      364.51 : Existing Incorrect Value
      374.51 : New Correct Value to Replace Old
```

Example 7. Delete Hydrograph Data (Hanford Designation for Well Names)

```
DELETE 0 0 841001
  6  42 12A   830601   404.40
END
```

Data Record Format (12A1,1X,F6.0,F10.0)

Explanation of Data Record:

```
  6  42 12A : Hanford Well Designation.
      830601 : Date of Measurement
      404.40 : Height of Water Table above Mean Sea Level
              in Feet.
```

Example 8. Insert Temperature Data (Hanford Designations or EMA Codes for Well Names and Constituents)

Example with Hanford Well Designation :

```

INSERT 2 0 800111
6 1 18 800111 17.10
      (Well) (Date) (Temperature)
END

```

Data Record Format for Above Example (12A1,1X,F6.0,F10.0)

Example with EMA Code Well Designation :

```

INSERT 2 1 800111
4513 800111 17.10
(EMA #) (Date) (Temperature)
END

```

Data Record Format for Above Example (15,1X,F6.0,F10.0)

Example 9. Modify Temperature Data (Hanford Designation or EMA Code for Well Names and Constituents)

Example with Hanford Well Designation :

```

CHANGE 2 0 800111
6 1 18 800111 16.10 17.10
END

```

Data Record Format for Above Example (12A1,1X,F6.0,2F10.0)

Data Record Explanation:

```

6 1 18 800111 16.10 17.10
      (Well) (Date) (Old Temp) (New Temp)

```

Example with EMA Code Well Designation :


```

CHANGE 2 1 800111
4513 800111    16.10    17.10
END

```

Data Record Format (I5,I1X,F6.0,2F10.0)

Data Record Explanation:

```

4513 800111    16.10    17.10
(EMA #) (Date) (Old Temp) (New Temp)

```

Example 10. Delete Temperature Data (Hanford Designation or EMA Codes for Well Names and Constituents)

Example with Hanford Well Designation :

```

DELETE 2 0 800111
6 1 18 800111    17.10
END

```

Data Record Format (I2A1,I1X,F6.0,F10.0)

Data Record Explanation:

```

Line 1 :
DELETE : Delete the Data in Line 2
2 : Temperature Data Type
0 : Hanford Well Designation
800111 : Current or Latest Date in File
Line 2 :
6 1 18 : Hanford Well Designation
800111 : Date of Measurement
17.10 : Value to be Deleted
Line 3 : END : End of Data Set

```

Example with EMA Code Well Designation:

```
DELETE 2 1 800111
4513 800111      17.10
END
```

Data Record Format (I5,I1X,F6.0,F10.0)

Data Record Explanation:

Line 1 :

DELETE : Delete the Data in Line 2

2 : Temperature Data Type

1 : Well Designation is by EMA Code

800111 : Current or Latest Date in File

Line 2 :

4513 : EMA Code for Hanford Well

800111 : Date of Measurement

17.10 : Temperature Value Deleted

Line 3 : END : End of Data Set

5.3 GENERATING GEOLOGIC DATA

The information obtained from a well driller's log can be very useful in the study and modeling of a ground-water system. The data can be retrieved rapidly to produce listings, cross-sectional plots of an individual well, or cross-sectional plots of wells projected to a user-selected reference line (the latter runs on the PDP 11/55 computer with scope and light pen capability).

The procedure for storing geologic data is as follows:

1. Enter well names, coordinates and casing elevations into the data base (see Section 2.0)

2. Determine local stratigraphy and assign ascending numbers to each stratigraphic layer. Table 3 shows the computer codes assigned to strata of the Pasco Basin used in a Hanford Study (Staff, Research and Engineering 1976)
3. Interpret driller's logs into stratigraphic layers and enter into the data base using the program WLGEN.

Previous to January 1977, driller's logs were entered as they appeared in old log books. Each entry that existed in these books for each well was entered into the data base. Much of the notation was, however, abbreviated in order to compact the massive amount of data. These data exist on one magnetic tape (Foreign) labeled DRILLERS LOGS (7/31/74). The data were read from cards by a program called READF, which packed the data for each well into a buffer and copied it to the magnetic tape. Each buffer size was directly related to the amount of data for the well of interest, thereby reducing the amount of wasted space on the tape. After all of the well data were transferred to magnetic tape, they could then be entered into the CIRMIS data base for rapid retrieval. A program called LGGEN.MAG was used to read the data from the magnetic tape and enter them into the data base.

Since the original driller's logs were not interpreted by geologists, they were found to be useless in many cases because drillers on the Hanford site over the past three decades may have logged identical soil types with descriptions ranging from exact to radically different. Geologists have since begun studying the original driller's logs and developed compacted interpreted logs based on known soil types and stratigraphy within the Hanford site. These new logs have replaced the original drillers logs in the data base. Continued studies may further update these interpretations.

5.3.1 Formatted Well Log Input File

The raw data for the new interpreted well logs are stored in a formatted file on disc and tape. The name of this file is specified by the user. The first six characters may be the same as other raw data file names but the seventh and eighth characters should be unique. As an example, Hanford data files are LOGDTA10.FOR, LOGDTA11.FOR, LOGDTA12.FOR, etc.

TABLE 3. Hanford Site Stratigraphic Computer Code Assignments

Aeolian Sediments	100
Touchet Silts	121
Pasco Gravels	202
Hanford Formation	203
Glaciofluvialite	204
Palouse Soil	205
Ringold Formation	300
Ice Harbor Member	401
Levey	402
Elephant Mountain Member	403
Pamona Member	405
Selah	406
Gable Mountain Member	407
Cold Creek	408
Huntzinger Member	409
Umatilla Member	410
Saddle Mountains Basalt Formation	411
Mabton	412
Priest Rapids Member	413
Roza Member	414
Frenchman Springs Member	415
Wanapum Basalt Formation	416
Vantage Sandstone Formation	417
Grande Ronde Basalt Formation	418
Yakima Basalt	419
Columbia River Basalt Group	420

The formatted log data must be stored on the CIRMIS File-Q disc in a direct access file (FRMTWLG) to be accessed by retrieval programs. FRMTWLG has pointers to each well's log data entered into the master header file (WELLHDR). This is done by a generator program called WLGGEN. This program has two modes of operation. These are 1) deleting any existing well log entries in the CIRMIS data base and regenerating a new data base and 2) appending new wells to the existing CIRMIS well log data base.

Well log data are first entered into a formatted file for input to WLGGEN. The file format is shown in Table 4.

TABLE 4. Card Format Used for Interpreted Hanford Well Logs

	<u>Column</u>	<u>Name</u>	<u>Description</u>	<u>Format</u>	<u>Data Type</u>
CARD TYPE 1					
Header Information	1	ICARD	Card Type Indicator (ICARD = 1)	I1	Integer
	2	ICONT	Not used	I1	Integer
	3-14	WDES	Well Designation	12A1	Byte
	15-20	DDATE	Date - drilled	A4,A2	Real
	21-26	CASEL	Casing elevation	F6.2	Real
	27-32	TOTDEP	Total Depth	F6.0	Real
	33-56	OWN	Owners' Name	6A4	Real
	57-80	DRL	Drillers Name	6A4	Real
CARD TYPE 2					
Strata Information	1	ICARD	Card Type Indicator (ICARD = 2)	I1	Integer
	2	ICONT	Line Continuation Indicator	I1	Integer
	3-14	WDES	Same as Card Type 1		
	15-20		Blank		
	21-26	BDEPTH	Top elevation at which strata begins	F6.0	Real
	27-32	Blank			

TABLE 4. (Contd)

	<u>Column</u>	<u>Name</u>	<u>Description</u>	<u>Format</u>	<u>Data Type</u>
	33-80	STRATA	Name of Strata (may exceed 12A4 12 real words if ICONT > 1)		Real
CARD TYPE 3					
Soil Type	1	ICARD	Card Type Indicator (ICARD = 3)	I1	Integer
	2	ICONT	Line Continuation Indicator (continuation line if ICONT > 1)	I1	Integer
	3-14	WDES	Same as Card Type 1		
	15-20	SHADE	Soil Descriptor (left justified)	A4,A2	Real
	21-26		Blank	6X	
	27-32	EDEPTH	Depth at which this soil ends	F6.0	Real
	33-80	SOILS	Name of Soil (may exceed 12A4 12 real words if ICONT > 1)		Real
CARD TYPE 4					
Comment	1	ICARD	Card Type Indicator (ICARD = 4)	I1	Integer
	2	ICONT	Line Continuation indicator (continuation line if ICONT > 1)	I1	Integer
	3-14	WDES	Same as Card Type 1		
	15-26		Blank		
	27-32	DEPTH	Depth at which comment applies	F6.0	Real
	33-80	COMM	Special comment (may exceed 12A4 12 real words if ICONT > 1)		Real

Below is a sample WLGGEN input file for one well (LOGDTA.FOR):

```

11 6 38 15 120479507.56490.0
21 6 38 15          0          GLACIOFLUVIAL SEDIMENTS
31 6 38 15 GS        35.0 SANDY GRAVEL, BASALT CLASTS
31 6 38 15 GS        55.0 GRAVEL, SUBANG-SUBRND F-C SAND, BASALT CLASTS
31 6 38 15 SMG       70.0 F. SUBRND SAND, OLIVE-BR SILT, GRAV
31 6 38 15 GSM      120.0 F-M SANDY GRAVEL, TR. DK. YELL. BR. SILT
21 6 38 15          120.0          RINGOLD FORMATION
31 6 38 15 MG       130.0 GRAVELLY PALE YELL. BR. CLAY
31 6 38 15 GM       150.0 CLAYEY GRAVEL, BASALT CLASTS
31 6 38 15 GSM      210.0 GRAVEL, F-C ANG. SAND, SILT
31 6 38 15 SM       215.0 WHITE VERY F-M SAND, SILT
31 6 38 15 SM       225.0 WHITE VERY F-M SAND, SILT, PLANT FRAGS.
31 6 38 15 GS       235.0 SANDY GRAVEL
31 6 38 15 SM       250.0 VERY F-M LT-GRAY SAND, SILT, FERRUGINOUS STAIN
31 6 38 15 GS       295.0 GRAVEL (B CLASTS), WHITE ANG-SUBANG SAND
32 6 38 15          295.0 PLANT FRAGMENTS
31 6 38 15 S        300.0 WHITE VERY F-M SAND
31 6 38 15 GS       310.0 GRAVEL, WHITE ANG-SUBANG SAND
31 6 38 15          315.0 NO SAMPLE
31 6 38 15 S        320.0 WHITE F-C SAND
31 6 38 15          325.0 NO SAMPLE
32 6 38 15          340.0 CLAY
31 6 38 15 SM       345.0 SILTY LT-GRAY TO WHITE SAND
31 6 38 15 SM       365.0 WHITE F-C ANG-SUBANG SAND, WAXY RNDED CLAY
31 6 38 15          375.0 NO SAMPLE
31 6 38 15 S        405.0 ANG-SUBANG VERY F-C WHITE TO GRAY-TAN SAND
31 6 38 15 GS       415.0 SANDY GRAVEL
31 6 38 15 M        425.0 SILTY MED-LT-GRAY CLAY, SPLINTER, BLOCKY
31 6 38 15 MS       445.0 CLAYEY SILT, LT-GRAY, F-M SAND, BLOCKY, ANG
31 6 38 15 SM       455.0 LT-GRAY VERY F-M SAND, CLAY
31 6 38 15 SG       475.0 VERY F-M ANG-SUBANG WHITE SAND, TR. GRAVEL

```

21	6	38	15		475.0	ELEPHANT MTN. MEMBER
31	6	38	15	B	490.0	WEATHERED BASALT

5.3.2 Programs for Checking Input File

Four programs, LOGDEPTH, LOGDATES, LOGSTRATA, and LOGSRTDUP, are used to check the new log data for various types of errors as described below.

The first step is to create a file called LOGFILES.DAT which contains a list of the new log data file names (even if there is only one file). The first four characters of the new log data file name(s) must be the disc identification (DB1:, DB2:, etc.), followed by the file name. For example:

DB1:LOGDTA01.FOR.

The four programs, LOGDEPTH, LOGDATES, LOGSTRATA, and LOGSRTDUP, use characters 10 through 12 of the file name to identify the log data file when writing error information. Therefore, these characters must be unique. After LOGFILES.DAT has been created, LOGDEPTH can be run.

LOGDEPTH reads the log data file(s) and checks each well for depth entries that are out of order. Depths must be listed from the top to the bottom of the well. LOGDEPTH will quit running if non-numeric characters are found in numeric fields. An output file (LOG.ERR) is created which will contain any errors in depths (if any), and the last well name read if there is an error in input that stops the program. LOG.ERR will also contain the well name of the deepest well, the depth, and the file in which the data for that well may be found. A message will also be written to the user's terminal, giving the number of depth errors found (if any). LOGDEPTH must be run and erroneous data corrected until no system errors nor "test depths out of order" occurs. When the final run has been made, then LOGDATES must be run.

LOGDATES reads the log data file(s), selects all type 1 lines (header information, a 1 in Column 1), writes columns 1 through 32 from that line and characters 10 through 12 of the file name to a file called LINE1LOG.DAT. The date that the drilling was started (from columns 15 through 20) is checked for errors. If there are any embedded blanks, or the month is not equal to 1

through 12, or the day is not equal to 1 through 31, or the year is not equal to 40 through the current year, then the data will be written to LOGDATE.LST. There are three wells in the Hanford data base that were drilled before 1940, and there are a few dates that are missing (blank). After LOGDATE.LST has been examined and all possible corrections have been made to the log data file(s), then LOGSTRATA must be run.

LOGSTRATA reads the log data file(s), selects all type 2 lines (strata information, a 2 in column 1) and writes the selection to LOGLINE2.DAT. After all type two lines have been written to the file LOGLINE2.DAT, that file is read and the strata are summarized and written to the file STRATA.LST. STRATA.LST contains a list of each different strata, the total number of times it occurs in all of the new log data files, and the data files in which it occurs. Examining STRATA.LST may show some misspelled strata. Check any single occurrences of strata to see if it is really unique or simply misspelled. An example of an error is when GABLE MTN. appears 40 times, but GABLE MNT. appears once. Obviously MNT. in the single entry should be MTN. to match the 40 entries. After STRATA.LST has been checked and all possible corrections have been made to the log data file(s), then LOGSRTDUP must be run.

LOGSRTDUP reads the log data file(s), writes the well name from type 1 lines (Columns 3 through 14), and characters 10 to 12 of the log data file name in which the well name was found, to the file LOGNAMES.LST. After all names have been found, then LOGNAMES.LST is read and the names are written to six scratch files. The sorting program can only handle up to 500 wells. Therefore, for the Hanford wells, the data are separated as follows: The 199, 399, 1199, and 3099 wells are written to LOG1.DAT. The 299E 1 through 299E 27 wells are written to LOGE1.DAT. All other 299E wells are written to LOGE28.DAT. The 299W 1 through 299W 17 wells are written to LOGW1.DAT. All other 299W wells are written to LOGW18.DAT. The 699 wells are written to LOG6.DAT. The six scratch files are read and sorted separately and then combined into LOGNAMES.SRT. LOGNAMES.SRT is then read and each well name is checked against the following name to locate any duplicate names. If duplicate names are found, the well names, and characters 10 to 12 of the log data

file(s) in which they were found, are written to WDUPCHK.LST. When all duplicates (if any) are removed, or otherwise corrected, then the log data are ready to be entered into the data base.

5.3.3 Entering Well Log Data with WLGGEN Program

WLGGEN uses the formatted log data input file specified by the user and stores it in the CIRMIS data base on a File-Q disc in a direct access file called FRMTWLG. As each well is read in, appropriate pointers and addresses are stored in the header file WELLHDR on the File-Q disc. The procedures for doing this are described below.

1. The CIRMIS File-Q disc must be mounted.
2. The formatted file RENAMED.WEL must contain the new and old well names of all renamed wells. These names may be found in the file WELLHDR.FOR. The format for RENAMED.WEL is (1X, 12A1, 5X, 12A1). The first 12 characters contain the new well name and the second 12 characters contain the old well name.
- 3A. The entire well log data base can be regenerated using formatted file(s) containing all of the log data using the following procedure:

```
RUN DB1:WLGGEN
**** WELL LOG RANDOM ACCESS FILE GENERATION ****
ENTER FILE Q DISC UNIT NUMBER 1
INPUT WELL LOG FILENAME      DB1:LOGDTA01.FOR
IS THIS A COMPLETE REGENERATION? (Y OR N) Y
** THE WELL LOGS ARE BEING REGENERATED **
WLGGEN  --  STOP
```

Table 3 shows the printout from WLGGEN for complete regeneration. The start block for the first well is at 0 because the data base has been completely regenerated.

TABLE 3. Complete Regeneration Using Step 3A

**** WELL LOG RANDOM ACCESS FILE GENERATION ****
"FRMTWLG"

TIME= 0:08:35 DATE= 24-JAN-76

<u>No.</u>	<u>Start Block</u>	<u>Start Word</u>	<u>No. of Words</u>	<u>Idbit (Octal)</u>	<u>Well Designation</u>
1	0	1	972	13	6 56 E4C
2	4	1	1172	10	6 12 1

38. If well logs are to be added to the existing data base, the following procedure is followed.

RUN DB1:WLGGEN

**** WELL LOG RANDOM ACCESS FILE GENERATION ****

ENTER FILE Q DISC UNIT NUMBER 1

INPUT WELL LOG FILENAME DB1:LOGDTA09.FOR

IS THIS A COMPLETE REGENERATION? (Y OR N) N

** THE WELL LOGS ARE BEING APPENDED WITH ADDITIONAL WELLS **

WLGGEN -- STOP

Table 4 shows the printout from WLGGEN using the "append" option. This printout shows that the start block for the first well is at 9 which was the next free location calculated from Step 2A.

TABLE 4. Appending Data Using Step 3B

**** WELL LOG RANDOM ACCESS FILE GENERATION ****
"FRMTWLG"

TIME= 08:10:16 DATE= 24-JAN-76

<u>No.</u>	<u>Start Block</u>	<u>Start Word</u>	<u>No. of Words</u>	<u>Idbit (Octal)</u>	<u>Well Designation</u>
1	9	1	330	13	3 1 2
2	11	1	256	13	3 4 1

The number of blocks required for storage of each well log can be calculated from the number of words contained in each log using the following equation:

$$\text{NBLKS} = (\text{NWORDS})/256 + 1$$

This is done in integer notation. Using the wells shown in Table 1 the block sizes are:

$$\text{Well 1} - \text{NBLKS} = (972)/256 + 1 = 4$$

$$\text{Well 2} - \text{NBLKS} = (1172)/256 + 1 = 5$$

Data for one well may be continued across block boundaries, but no block contains data for more than one well. Therefore, the last block for each well may not be full.

The storage locations for each well are:

	<u>Start Block</u>	<u>End Block</u>
Well 1	0	3
Well 2	4	8

The next free location is therefore at block Number 9.

Table 5 shows a printout if the two wells in Table 3 and the two wells in Table 4 were combined and the data base totally regenerated using Step 2A.

When the WLGGEN program has terminated and the line printer listing has been produced (Tables 3, 4 and 5), all of the log data are ready for access.

5.4 GENERATING WELL STRUCTURE DATA

Well structure data consist of five types of information for each well. Each data type is of variable length. The five types are: 1) casing size and lengths, 2) perforation type and location, 3) screen size and location, 4) comments and 5) piezometer information.

TABLE 5. Complete Regeneration Using the Four Wells in Tables 3 and 4

**** WELL LOG RANDOM ACCESS FILE GENERATION ****
 "FRMTWLG"

TIME= 08:20:52 DATE= 24-JAN-76

<u>No.</u>	<u>Start</u> <u>Block</u>	<u>Start</u> <u>Word</u>	<u>No. of</u> <u>Words</u>	<u>Idbit</u> <u>(Octal)</u>	<u>Well</u> <u>Designation</u>
1	0	1	972	13	6 56 E4C
2	4	1	1172	10	6 12 1
3	9	1	330	13	3 1 2
4	11	1	256	13	3 4 1

These data are entered into a file called WSTDCU.FOR. The well structures generation program, WSTGEN, reads and interprets data from WSTDCU.FOR, packs data for each well into a buffer (256 integer words), and, when the buffer is full, writes it to the direct access disc file FRMTWST. The disc address, the position in the buffer of the starting word, and the number of words for this well are written to the file WELLHDR when all data for a well have been read. A buffer (or block) may contain data for more than one well, or the data for one well may be continued across buffer (or block) boundaries.

Table 6 shows the file format for WSTDCU.FOR, and Table 7 is a key to the coded data in card type 2 of WSTDCU.FOR.

TABLE 6. Format of WSTDCU.FOR For Well Structure Data

	Column	Name	Description	Format	Data Type
CARD TYPE 1					
CASING INFORMATION	1	I1	Card Type Indicator (I1 = 1)	I1	Integer
	2	I2	Continuation Indicator (Continuation Line if I2 > 1)	I1	Integer
	3-14	W	Well Designation	12A1	Byte
	15-18	DIAM	Casing Diameter (ft)	F4.2	Real
	19-74	CAS(1-8)	Accumulated total feet of casing. (CAS may exceed 8 real words if I2 > 1)	8F7.2	Real
CARD TYPE 2					
CASING PERFORATION	1	I1	Card Type Indicator (I1 = 2)	I1	Integer
	2	I2	Continuation Indicator (continuation line if I1 > 1)	I1	Integer
	3-14	W	Same as for Card Type 1		
	15-22	PF(1-5)	Perforation Top Depth (ft)	F8.0	Real
			Perforation Bottom Depth (ft)	F8.0	Real
			No. of Holes Per Round	F1.0	Real
			Hole Spacing	F1.0	Real
			Pattern of Holes (PF may exceed 5 real words if I2 > 1)	F1.0	Real
CARD TYPE 3					
SCREEN INFORMATION	1	I1	Card Type Indicator (I1 = 3)	I1	Integer
	2	I2	Continuation Indicator (continuation line if I1 > 1)	I1	Integer
	3-14	W	Same as for Card Type 1		

TABLE 6. (Contd)

Column	Name	Description	Format	Data Type
15-37	S(1-4)	Screen-Top Depth (ft) Screen-Bottom Depth (ft) Screen Diameter Screen Size (S may exceed 4 real words if I2 > 1)	F8.0 F8.0 F4.0 F3.0	Real Real Real Real
CARD TYPE 4 COMMENT				
1	I1	Card Type Indicator (I1 = 4)	I1	Integer
2	I2	Continuation Indicator (continuation line if I1 > 1)	I1	Integer
3-14	W	Same as for Card Type 1		
15-78	CM(1-16)	Comments (CM may exceed 16 real words if I2 > 1)	16A4	Real
CARD TYPE 5 PIEZOMETER INFORMATION				
1	I1	Card Type Indicator (I1 = 4)	I1	Integer
2	I2	Continuation Indicator (continuation line if I1 > 1)	I1	Integer
3-14	W	Same as for Card Type 1		
15-78	PZ(1-4)	Piezometer Tube Designation Piezometer Length Perforation-Top Depth (ft) Perforation-Bot Depth (ft) (PZ may exceed 4 real words if I2 > 1)	A1 F5.0 F5.0 F5.0	Real Real Real Real

TABLE 7. Key to Coded Data in WSTDCU.FOR (Computer Codes are Internal to the Program)

<u>Holes/Round</u>	<u>Card Value</u>	<u>Computer Code</u>
0	0	B10
4	4	B4
11	7	B27
12	9	B29

<u>Spacing</u>	<u>Card Value</u>	<u>Computer Code</u>
6 in.	0	WDC10
12 in.	1	WDC1
10 in.	2	WDC2
24 in.	3	WDC3
8 in.	4	WDC4
36 in.	5	WDC5
9 in.	6	WDC6
5 ft	7	WDC7
18 in.	8	WDC8
16 in.	9	WDC9

<u>Type of Cut</u>	<u>Card Value</u>	<u>Computer Code</u>
Regular	0	REG
Staggered	1	STAG
Spiral	2	SPIR

6.0 QUARTERLY BACK-UP ACTIVITIES

Four times per year, various programs are run to insure that disks, tapes and line printer listings of various information are updated. The following subsections describe these programs.

6.1 CIRMIS FORMATTED OUTPUT PROGRAM (CRMFOR)

CRMFOR creates formatted files from the CIRMIS direct access files that can be used by the regeneration programs HYDGEN, TMPGEN, and CTMGEN, to generate the data base, if necessary. CRMFOR is used primarily to provide a back-up copy of the data for quick reference.

The files used and created by CRMFOR are:

Name	Type	Access
WELHDRNEW.SEQ (WELHDR ADDRESS FILE)	FORMATTED	READ
FILE-Q WELHDR	RANDOM	READ
FILE-Q FRMTHYD (HYDROGRAPH FILE)	RANDOM	READ
FILE-Q FRMTTMP (TEMPERATURE FILE)	RANDOM	READ
FILE-Q FRMTCTM (CONTAMINANT FILE)	RANDOM	READ
FILE-Q CTMHDR (CONTAMINANT HEADER FILE)	RANDOM	READ
HYDRO.FOR	FORMATTED	WRITE
TEMPER.FOR	FORMATTED	WRITE
XXMMDDYY.FOR	FORMATTED	WRITE

HYDRO.FOR and TEMPER.FOR are renamed by the user after generation to HYDMMDDYY.FOR and TMPMMDDYY.FOR where MMDDYY is the current date. The XX in XXMMDDYY.FOR is a constituent abbreviation (i.e., TA for total alpha), and MMDDYY is the current date. Thirty-two of these files may exist. Constituent abbreviations used by CRMFOR are shown in the following list:

EMA CODE	CONSTITUENT CODE	START ADDRESS			
112	1 -- (0)	-- TA	--	Total Alpha	
111	2 -- (2000)	-- TB	--	Total Beta	
108	3 -- (6000)	-- TR	--	Tritium	
115	4 -- (10000)	-- NI	--	Nitrate	
121	5 -- (14000)	-- ST	--	Strontium-90	
24	6 -- (17000)	-- CE	--	Cesium-137	
10	7 -- (20000)	-- CO	--	Cobalt-60	
104	8 -- (23000)	-- UR	--	Uranium	
103	9 -- (26000)	-- PL	--	Plutonium-239	
34	10 -- (28000)	-- RU	--	Ruthenium-106	
114	11 -- (31000)	-- CR	--	Chromium	
26	12 -- (33000)	-- FL	--	Fluoride	
54	13 -- (35000)	-- MA	--	Magnesium	
100	14 -- (37000)	-- PO	--	Pu 239/240	
102	15 -- (39000)	-- P8	--	Pu 238	
57	16 -- (41000)	-- CL	--	Chloride	
58	17 -- (43000)	-- CP	--	Copper	
62	18 -- (45000)	-- HD	--	Hardness	
63	19 -- (47000)	-- SD	--	Solids	
116	20 -- (49000)	-- NN	--	Nitrate Ion	
198	21 -- (51000)	-- TC	--	Total Organic Carbon	
199	22 -- (53000)	-- PH	--	pH	
200	23 -- (55000)	-- SU	--	Sulfate	
201	24 -- (57000)	-- SO	--	Sodium	
202	25 -- (59000)	-- CA	--	Calcium	
998	26 -- (61000)	-- TG	--	Total Gamma	
188	27 -- (63000)	-- BI	--	Bicarbonate Ion	
189	28 -- (65000)	-- CI	--	Carbonate Ion	
190	29 -- (67000)	-- TP	--	Total Potassium	
191	30 -- (69000)	-- SC	--	Specific Conductivity	
192	31 -- (71000)	-- BN	--	Boron	
212	32 -- (73000)	-- LA	--	Low Alpha	

CRMFOR may be used for analytical, water level or temperature data. The program asks for WELHDRNEW.SEQ and the desired data type. The name of the file created by CRMFOR is then written to the screen.

6.2 PROGRAM WELNPTS FOR DATA SUMMARIES

WELNPTS is run to provide a quick reference on the number of data points for each data type for each well stored in the data base. The following interactive run sequence is followed (underlined information is entered by the user):

```
PDS>> RUN DB1:WELNPTS
```

```
08:18:00
```

```
ENTER DISC & UNIT FOR OUTPUT FILES >DB1:
```

```
YOUR OUTPUT FILES ARE: DB1: CTMDAT.LST
```

```
DB1:WELNPTS.LST
```

```
ENTER FILE-Q DISC UNIT (i.e., DP2, DP1 or DB0) >DB1:
```

```
ENTER "?SEQ" FILE CONTAINING WELL NAMES AND ADDRESSES > DB1:WELHDRNEW.SEQ
```

```
ENTER NO. OF WELLS (1-6000) > 6000
```

```
--STOP
```

As indicated above, the output files are called CTMDAT.LST and WELNPTS.LST, and can be found on the DB1: disk if the first question is answered as shown.

7.0 WELL DATA LISTING FOR THE HANFORD WELLS REPORT

The technical services portion of the Ground-Water Surveillance Program periodically publishes a report called "Hanford Wells" which contains updated information on wells existing from the days before construction of the Hanford Works to the present (McGhan, Mitchell and Argo 1985). The report is used by DOE contractors needing condensed, tabular information on the location, construction and completion dates for Hanford site wells.

As new data become available from field personnel, the formatted input file to program WELDOC is edited and renamed to DCUMNT.DAT (note that this file is not currently accessible with CIRMIS programs). After WELDOC is run to create the readable table listing (with column headings) which is used in the report, DCUMNT.DAT and the output file, DCUMNT.LST, are renamed DCUMNTYYM.DAT and DCUMNTYYM.LST, respectively, where the current year (e.g. 84) and month (e.g., A for April) are substituted for YYM in both names. These files are copied to tape for storage. The output file may be printed out at any time for anyone who needs the most current information between report publications.

The following subsections describe in detail the required input format for DCUMNT.DAT and the procedure for running program WELDOC.

7.1 FORMAT OF INPUT FILE TO PROGRAM WELDOC

Data required as input to program WELDOC must exist in the following format in file DCUMNT.DAT [explanations for most items are provided in McGhan, Mitchell and Argo (1985)].

CARD TYPE 1: Well Completion Information

<u>Column</u>	<u>Description</u>	<u>Format</u>
1-2	Card type = 1	I2
5-16	Well name	A12
17	Coordinate type (D, R, or H)	I1
18	North (N) or South (S)	I1

19-24	North or South coordinate	I6
25	West (W) or East (E)	I1
26-31	West or East coordinate	I6
33-38	Casing elevation (ft) above mean sea level (e.g., 439.79 is entered as 043979)	I6
41-42	Initial depth to water when drilled (ft)	I2
44-45	Casing diameter (in.)	I2
47-51	Depth drilled (ft) (e.g., 63.0 is entered as 00630)	I5
53-57	Depth to bottom (ft) (e.g., 65.2 is entered as 00652)	I5
59-62	Date completed (e.g., June 1953 is entered as 0653)	I4
64-67	EMA number	I4
69-73	EMA code for Rockwell sampling	I4
76-82	Minimum and maximum perforated depths (ft) (e.g., 20-40)	A7
87	Flag for destroyed or active wells (1 = Destroyed, 0 = Active)	I1

CARD TYPE 2: Former Designation, Rockwell File Number and Comments

Column	Description	Format
1-2	Card type = 2	I2
5-14	Former designation	A10
29-48	Comments	A20
49-65	Comments continued (appear just below first set)	A17
69-74	Rockwell file number (e.g., 2-61-12 is entered as 026112)	I6

CARD TYPE 3: Piezometer Information

Column	Description	Format
1-2	Card type = 3	I2
5	Piezometer label (e.g., P, Q, R, S)	I1
13-19	Minimum and maximum perforated depths (e.g., 20-40)	A7
21-22	Piezometer diameter (in.) (e.g., 1.5 is entered as 15)	I5
24-27	EMA number	I4
29-32	Depth to bottom (ft) (e.g., 780.5 is entered as 7805)	I4
35-36	Initial depth to water (ft)	I2

44-47	Completion date (e.g., June 1980 is entered as 0680)	I4
87	Flag for destroyed or active wells (1 = Destroyed, 0 = Active)	I1

CARD TYPE 4: (to start a new page in formatted listing)

<u>Column</u>	<u>Description</u>	<u>Format</u>
1-2	Card type = 4	I2

7.2 CREATING LISTINGS WITH PROGRAM WELDDC

The input file, DCUMNT.DAT must exist on DB0: to run DB1:WELDDC. The following question will appear on the screen:

DO YOU WISH TO PRINT ALL WELLS? (YES OR NO)

If YES is answered, all active and destroyed wells are processed. An answer of NO will only process active wells to create the output file DCUMNT.LST. The well names will appear on the screen as the program runs to aid in locating format errors. The program has run successfully when STOP appears on the screen. The output file DCUMNT:LST can be found on DB0: to be renamed and stored on DB1: and tape.

PART II. USER'S MANUAL

1.0 INTRODUCTION

This part of the report is directed toward those who want to retrieve data from the computerized Hanford Ground Water Data Base maintained on the PDP 11/70 computer in the Geosciences Research and Engineering Department. The interactive program, MNTR, can be used to obtain listings of data on the line printer or on the screen of a terminal, create files of data on disk, or plot historical data on the Calcomp plotter. Various analytical data are printed for Pacific Northwest Laboratory (PNL) and Rockwell Hanford Operations (Rockwell) annual reports using the programs APPENA, APPENB and APPENAR.

2.0 DATA RETRIEVAL (MNTR)

MNTR is the main retrieval program which utilizes appropriate subroutines to carry out the desired action. MNTR is designed to retrieve nine types of data, only five of which exist in the data base at the present time. The nine data types are listed below with an asterisk preceeding the existing five:

- * 1. Hydrograph
- * 2. Analytical
- * 3. Well Structure
- * 4. Geologic
- 5. Sieve Analysis
- 6. Aquifer Tests
- 7. Physical Properties of Soils
- 8. Chemical Properties of Soils
- * 9. Temperature

The following sections give instructions for terminals that are hard-wired into the Geosciences Research and Engineering Department's PDP 11/70 computer, or for the Tektronics graphic terminal in the 300 Area after dialing in via modem.

Follow the procedure shown in Section 2.1 for interactive data retrieval. If various data for several wells are desired, a command file may be used by answering 'Y' for the second question and entering the name of the command file when prompted (see Section 2.2). All underlined data are entered by the user after each prompt by the program. The RETURN key must be used after each entry.

2.1 INTERACTIVE USE OF MNTR

The user must first log onto the computer prior to running MNTR. This is done by typing the hit CTRL and C keys at the same time. The user will see something like this:

```
IAS PROGRAM DEVELOPMENT SYSTEM  VERSION 3.1
      (time)                      (date)
      GEOSCIENCES DOE PDP-11/70  (PNLY)
```

Logging on is done as follows (password must be obtained from the data base manager) where user responses are underlined:

```
PDS>> LOGIN CIRMIS  
PASSWORD                       
User CIRMIS UIC[351,100]TT00: 13:33:50 29-MAY-1984
```

Now the user may run MNTR as follows:

```
PDS>> MNT
```

(Note: If the following does not appear after MNT, type
@[351,100]DB1:CIRMISINS and try again.)

```
**** CIRMIS MONITOR CONTROL PROGRAM ****  
Enter File-Q Disc Unit (I.E. DB1,DB2,) > DB1  
Is there a special command file? (Y or N) > N  
Enter desired data type code  
          (0=HYD, 1=CTM, 2=WST, 3=WLG, 10=TMP) > 1  
Enter desired contaminant code (1-32) > 4  
Enter desired output code:  
1 = TERMINAL LISTING  
2 = LINE PRINTER LISTING  
3 = DISK FILE LISTING  
4 = PLOT FILE CREATED ON DISK  
5 = PLOT ON TERMINAL
```

```
1  
Enter Well Designation (12A1) > 6 63 9
```

Contaminant Data - Well No. 6 63 9

Contaminant Type -- Nitrate (mg/l)

Measurements to Date = 9

DATE	VALUE	DATE	VALUE	DATE	VALUE
9-JAN-58	1.20E+00	12-FEB-58	2.70E+00	13-MAR-58	2.80E+00
10-APR-58	2.40E+00	8-MAY-58	2.20E+00	11-DEC-58	3.00E+00
1-APR-59	3.00E+00	1-JUL-59	2.00E+00	5-DEC-62	2.90E+00

Successful Access

00 You Want Another? (Y OR N) > Y

Enter desired data type code

(0=HYD, 1=CTM, 2=WST, 3=WLG, 10=TMP) > 1

Enter Desired Contaminant Code (1-32) > 4

Enter desired output code:

1 = TERMINAL LISTING

2 = LINE PRINTER LISTING

3 = DISK FILE LISTING

4 = PLOT FILE CREATED ON DISK

5 = PLOT ON TERMINAL

3

Enter Well Designation (12A1) > 6 63 9

Your Contaminant Output File is "CTM.FIL"

Successful Access

Do You Want Another? (Y OR N) > Y

Enter desired data type code

(0=HYD, 1=CTM, 2=WST, 3=WLG, 10=TMP) > 1

Enter Desired Contaminant Code (1-32) > 4

Enter desired output code:

1 = TERMINAL LISTING

2 = LINE PRINTER LISTING

3 = DISK FILE LISTING

4 = PLOT FILE CREATED ON DISK

5 = PLOT ON TERMINAL

4
Enter Well Designation (12A1) > 6 63 9
Plot is Called DB1:CTM.PLT

SUCCESSFUL ACCESS
DO YOU WANT ANOTHER? (Y OR N) > N
\$\$\$\$MNT -- STOP

The user will end the session by typing "Logout" or "Bye" as follows:

PDS>> BYE

User CIRMIS UIC [351,100]TT00: 13:36:25 29-MAY-1984
13:36:25 END PDS CIRMIS TT00:
BYE

2.2 COMMAND FILE FOR MNTR

A command file may be used with MNTR to retrieve data for several wells automatically. The first line of a command file must contain the number of wells for which data are to be retrieved. Then each well must be listed by Hanford designation with one, two, or three lines of data below the well name to specify data type and format. The general file format is shown below:

Line 1: Number of wells
Line 2: Well name
Line 3: IDTYPE, IOTYPE, IYR1, IYR2, NCONT
Line 4: Constituent Codes for desired constituents (see page 16)
Line 5: N (this line only required if IDTYPE = 1)
(Repeat lines 2 through 5 for other wells desired)

Explanation for Line 3

The following values may be used for the variables in line 3:

IDTYPE: 0 = water levels
1 = sample analytical data
2 = well structure
3 = geologic log
10 = temperature
IOTYPE: 1 = terminal listing
2 = line printer listing
3 = disk file listing
4 = plot file created on disk
5 = plot on terminal
IYR1, IYR2: 0,0 is used when all years are desired, otherwise, enter
starting and ending years in I2, I2 format (e.g., 80, 84
for 1980 through 1984).
NCONT: Enter number of constituents desired if IDTYPE=1

3.0 CREATING TABLES FOR ANNUAL REPORTS

Annually, on a calendar year basis, PNL and Rockwell request formatted listings (with column headings) of various data for various wells for their annual reports. The APPENA and APPENB programs are run for PNL, and the APPENAR and APPENBR programs are run for Rockwell.

3.1 PROGRAM APPENA

The output from program APPENA is used as Appendix A for PNL's annual surveillance report (e.g., Eddy, Prater and Rieger 1983). The formatted output file contains minimum, maximum, and average values for selected constituents and wells for any input years. If more than 8 constituents are selected, the first 8 are printed for all wells requested, then the next 8, etc.

The following interactive stream is followed in running APPENA, where the user's response is underlined.

```
PDS>> RUN OB1:APPENA
ENTER FILE-Q DISC UNIT (i.e., DP2, DP1 or DB0) > OB1
ENTER INPUT FILE CONTAINING WELL NAMES > OB1:BNWWEL.SEQ
SPECIFY START MONTH AND YEAR (212) > 0184
SPECIFY END MONTH AND YEAR (212) > 1284
ENTER TYPE OF DATA
  (1 = BATTELLE, 2 = ROCKWELL, 3 = BOTH) TYPE = 1
IS ONLY A DATA FILE FOR WELL PLOT DESIRED? N
DO YOU WANT ALL CTM #s? > N
ENTER CTM #s (MAY BE ENTERED AS 1,3,4,8-10,15,20-26) 3,4,5-7,6,10
*****APPENA IS FINISHED*****
YOUR FORMATTED FILE FOR LISTING IS APPENA.LST
--STOP
```

The output file, APPENA.LST on DB0:, is then printed on the line printer or letter-quality spinwriter for use in the annual report. (Use program APPENAR to create listing for Rockwell).

3.2 PROGRAM APPENB

The output for program APPENB is used as Appendix B in PNL's annual surveillance report (e.g., Eddy, Prater and Rieger 1983). The program creates a formatted file containing all total alpha, strontium, cesium, cobalt, uranium, ruthenium, chromium, and fluoride sample analytical data stored in the data base for the wells (in the input file) and year. BNWWEL.SEQ must be available on DBO for TYPE = 1. Rockwell may request that this program be run for total beta, tritium and nitrate (TYPE = 2) and RCKWEL.SEQ must be available on DBO: for use as the input file. These files contain the list of well names to be processed.

The following interactive stream is followed to run APPENB, where the user's response is underlined.

```
PDS>> RUN DB1:APPENB
ENTER FILE-Q DISC UNIT (i.e., DP2, DP1 OR DBO:) DB1
ENTER TYPE OF DATA
  (1 = BATTELLE, 2 = ROCKWELL) TYPE=1
SPECIFY DESIRED YEAR (I2) > 85
*****APPENB IS FINISHED*****
YOUR LISTING FILE IS APPENB.LST
--STOP
```

3.3 PROGRAM APPENAR

The output from program APPENAR is used in annual reports written by Rockwell. It performs the same operation as program APPENB to create a listing of minimum, maximum, and average values for selected constituents and wells (in a given input file) for any input years. The following interactive input stream is followed to run the program, where the user's response is underlined.

```
PDS>> RUN DB1:APPENAR
ENTER FILE-Q DISC UNIT (i.e., DP2, DP1 OR DBO:) > DB1
ENTER INPUT FILE CONTAINING WELL NAMES > DB1: RCKWEL.SEQ
SELECT
```

- (1) AVERAGE OVER ONE TIME PERIOD
- (2) AVERAGE FOR EVERY YEAR DURING HISTORY

1

SPECIFY START MONTH AND YEAR (212 > 0184

SPECIFY END MONTH AND YEAR (212) > 1284

ENTER TYPE OF DATA

(2 = ROCKWELL, 3 = BOTH) TYPE = 2

IS ONLY A DATA FILE FOR WELL PLOT DESIRED? (Y or N) > N

DO YOU WANT ALL CTM #s? > N

ENTER CTM #s (MAY BE ENTERED AS 1,3,4,8-10,15,20-26) 3,4

***** APPENA FINISHED *****

YOUR FORMATTED FILE FOR LISTING IS APPENAR.LST

--STOP

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- McGhan, V. L., P. J. Mitchell and R. S. Argo. 1985. Hanford Wells. PNL-5397, Pacific Northwest Laboratory, Richland, Washington.
- Staff, Research and Engineering Division. 1976. Feasibility Study on Storage of Radioactive Wastes in Columbia River Basalt. ARH-ST-137, Atlantic Richfield Company, Richland, Washington.

APPENDIX A
SEQUENTIAL STORAGE

APPENDIX A

SEQUENTIAL STORAGE

Sequential storage of the well name allows 12 bytes per name and 42 names per disc sector in the well name file WELLNAM. Eight bytes are not used and are left at the end of each sector. All direct access disc files begin with a disc address of zero (0); therefore, the first 42 well names would be stored in disc sector 0, the second 42 well names are stored in disc sector 1, and so forth. As the name of each well is stored in the WELLNAM file, the well name, coordinates, and casing elevation are stored sequentially (one 256 word disc sector per well) in the direct access disc file WELLHDR and the well name and WELLHDR disc address is written to a formatted file WELHDRNEW.SEQ. WELHDRNEW.SEQ is used when all wells in the data base are to be searched for information and provides a rapid access to the WELLHDR file.

Figure 1 shows the storage configuration for both WELLNAM and WELLHDR. This figure also shows examples of wells (1 and 87) stored in the WELLNAM file and their header blocks stored in WELLHDR.

The method of retrieval uses the following equation:

$$WHSCTR = WNSCTR * 42 + LOC - 1$$

where:

LOC = Numerical location in sector (1 to 42)

WNSCTR = WELLNAM sector address (0 to 142)

WHSCTR = WELLHDR sector address (0 to 5999).

For example, the first well would have a WELLHDR disc sector address of 0 ($WHSCTR = 0 * 42 + 1 - 1$), the 87th well would have a WELLHDR disc sector address of 86 ($WHSCTR = 2 * 42 + 3 - 1$).

This sequential method of storage uses the same number of disc sectors in the WELLHDR file as there are wells to be stored. If there were 87 wells to be stored in the data base, only 3 sectors ($IFIX(87/42 + 1)$) would be used in the WELLNAM file and 87 sectors used in the WELLHDR file. If 6000 wells (maximum

allowable) were stored in the data base then 143 sectors ($6000/42 + 1$) would be used in the WELLNAM file and 6000 sectors used in the WELHDR file.

PATTERNED STORAGE

Patterned storage can be used if some unique patterns are detected in the assigned well designations. The storage and retrieval procedures are altered to make a more rapid search sequence. The Hanford wells show unique patterns in the first two characters of the well designation (this will be discussed later). Once a pattern has been determined, and the categories selected, the user assigns starting disc sectors (42 well names per sector) in the WELLNAM file for each category. The number of wells in each category is determined by examining the formatted data file WELHDR.FOR and this number is used to determine the number of required sectors.

The Hanford system has eight unique categories assigned to well designations. The well designation prefixes were originally 199, 299E, 299W, 399, 699, 1199, 3099, and 499; however, these prefixes were shortened to 1, 2E, 2W, 3, 6, 11, 30, and 4 prior to entering into the WELHDR.FOR data file. Table 1 shows the storage configuration selected for the Hanford wells.

TABLE 1. Hanford Storage Allocation

<u>Well Prefix</u>	<u>Sector Range</u>	<u>No. of Sectors</u>	<u>Wells Stored</u>	<u>Max. No. of Wells</u>
1	0 to 4	5	105	210
2E	5 to 34	30	555	1,260
2W	35 to 69	35	801	1,470
3	70 to 74	5	37	210
6	75 to 124	50	781	2,100
11	125 to 129	5	105	210
30	130 to 131	2	9	84
4	132 to 134	<u>3</u>	<u>3</u>	<u>126</u>
	Totals	135	2,396	5,670

It should be noted that more sectors were assigned to each category than were required to hold the names to be stored so that additional wells could be added at a later date. For example, the number of wells with a prefix of 2W are 801 which would take 20 sectors ($(801/42) + 1$), but 35 sectors (35-69) were assigned to take care of future expansion.

The starting disc sectors for each category are shown as the first number under the title "Sector Range" in Table 1 (example: starting disc sector for 2E is 5).

These starting disc sectors are then entered into the generator program WHDRGEN to calculate the disc sector address in WELLNAM where the well name is to be stored. The starting disc sectors are also entered into the retrieving program RTVHDR. RTVHDR does a sequential search of the names in the WELLNAM file until a match is found for a requested well. The retrieval routine accesses one disc sector at a time and searches the 42 names for a match. If a match is not found, the next sector is accessed and searched until all sectors and names have been checked. If a match in well names has occurred, the disc sector address for WELLHDR is calculated and the parameters retrieved according to the following equation:

$$WHSCTR = (WNSTRT + NSEC - 1) * 42 + LOC - 1$$

where:

WHSCTR = WELLHDR sector address (0 to 5999)

WNSTRT = category starting sector address in WELLNAM

NSEC = number of sectors read (1 to N)

LOC = numerical location of name in sector (1 to 42)

$$WHSCTR = (5 + 1 - 1) * 42 + 1 - 1 = 210$$

APPENDIX B
CRMSED SUBROUTINES

APPENDIX B

CRMSED SUBROUTINES

CRMSED is not one program, but a main program with several subordinate programs. The main program, CRMSED, determines what type of data it is dealing with and what needs to be done with it, and then it calls the appropriate subprogram to carry out the details of the action. A listing of the routines comprising the CRMSED package with a very brief description of each, is given below.

CIRMIS EDITING ROUTINES

CRMSED - Main Program - Selects 1 of 3 Driver Routines

EDICTM - Contaminant Driver Routine - Selects 1 of 3
Contaminant routines

CTMINS - Contaminant "Insert" Routine

CTMDEL - Contaminant "Delete" Routine

CTMCHG - Contaminant "Change" Routine

EDIHYD - Hydrograph Driver Routine - Selects 1 of 3
Hydrograph Routines.

HYDINS - Hydrograph "Insert" Routine

HYDDEL - Hydrograph "Delete" Routine

HYDCHG - Hydrograph "Change" Routine

EDITMP - Temperature Driver Routine - Selects 1 of 3
Temperature Routines.

TMPINS - Temperature "Insert" Routine
TMPDEL - Temperature "Delete" Routine
TMPCHG - Temperature "Change" Routine

BSRCH - Binary Search to Locate Chronological Position
in the File for Insertion of New Data Point.

EMASRH - Searches "EMACODE" for Well Location When Given
"EMA" Number.

DATCHK - Checks Incoming Date to Determine if it is
reasonable.

RTVHDR - Locates Address of "WELLHDR" File for Incoming
Well Location.

CRMSED determines the action to be taken from the control record, then calls one of the three subroutines EDICTM, EDIHYD, or EDITMP, depending upon whether it's dealing with contaminant, hydrograph, or temperature data. Then, that program determines the type of action desired on the data and calls the appropriate insert, delete, or change subroutine. If the well designation is by EMA code, these programs then call EMASRH (EMA SeaRCH) to match the EMA code with the Hanford well designation. Once the Hanford well designation is found, RTVHDR is called to retrieve the header information for that well. The header information contains, among other things, the location (address) of the desired data on the disk. Those data are then read in.

Having read the date associated with the new data in the input file, the program (at this point either an "INS", "DEL", or "CHG" program) calls BSRCH to rapidly and efficiently locate where that date falls in the existing data (or outside it). If the update action is an "INSERT", the data are added to the block of data read in from disk, the appropriate "pointers" are updated, and the data are written back to disk. If the update action is a "CHANGE" or "DELETE", then BSRCH must find the corresponding date already existing in the data base. If it does, the program goes ahead and carries out the action. If

it doesn't match the input date with an already existing date, then the program writes a warning to the user that it encountered an "INVALID DATE" and writes out the well name and input date along with an echo of the input record.

REGENERATING PROGRAMS

CTMGEN, HYDGEN, and TMPGEN are regeneration programs that read the formatted output files of CRMFOR to regenerate the data base in the event that file-Q data files are lost. A description of each program is given below:

Contaminant Regenerating Program - CTMGEN

CTMGEN will read formatted contaminant output files from CRMFOR and regenerate contaminant data. CTMGEN is used to remove empty sectors from the disc that may be caused by a large number of contaminant data deletions or to restore the data base if tape and disc backups fail or a need arises to restore the data base from some prior date.

The files used by CTMGEN are:

<u>Name</u>	<u>Type</u>	<u>Access</u>
FILE-Q WELLNAM	RANDDM	READ
FILE-Q WELLHDR	RANDOM	READ/WRITE
FILE-Q UPDATEHDR	RANDOM	READ/WRITE
FILE-Q CTMHDR	RANDOM	READ/WRITE
FILE-Q FRMTCTM	RANDOM	WRITE
* XXMMDDYY.FOR	FORMATTED	READ

* XX = the 2-letter abbreviation of the contaminant
(i.e., TA = Total Alpha)

Instructions for Operating CTMGEN

. PDS>> RUN CTMGEN (CR)

Enter FILE-Q disc number (A2,I1) DB1:

1. Enter contaminant file name TA031979.FOR

2. Enter contaminant code 1

3. Do you want another species? (Y or N) Y

Repeat 1-3 until all contaminant files are finished.

Hydrograph Regenerating Program - HYDGEN

HYDGEN will read HYDRO.FOR (formatted output file from CRMFOR) and regenerate hydrograph data. HYDGEN is used to remove empty sectors from the disc that may be caused by a large number of hydrograph data deletions, or to restore the data base if tape and disc backups fail or a need arises to restore the data base from some prior date.

The files used by HYDGEN are:

<u>Name</u>	<u>Type</u>	<u>Access</u>
FILE-Q WELLNAM	RANDOM	READ
FILE-Q WELLHDR	RANDOM	READ/WRITE
FILE-Q UPDATEHDR	RANDOM	READ/WRITE
FILE-Q FRMTHYD	RANDOM	WRITE
HYDRO.FOR	FORMATTED	READ

Instructions for Operating HYDGEN

Copy the HYDMMDDYY.FOR file for the date wanted to DB1: example:

PDS>> PIP DB1:HYDRO.FOR=DB1:HYD031979.FOR

PDS>> RUN DB1:HYDGEN (CR)

ENTER FILE-Q DISC UNIT NUMBER (A2,I1) DB1:

Temperature Regenerating Program - TMPGEN

TMPGEN will read TEMPER.FOR (formatted output file from CRMFOR) and regenerate temperature data. TMPGEN is used to remove empty sectors from the

disc that may be caused by a large number of temperature data deletions, or to restore the data base if tape and disc backups fail or a need arises to restore the data base from some prior date.

The files used by TMPGEN are:

<u>Name</u>	<u>Type</u>	<u>Access</u>
FILE-Q WELLNAM	RANDOM	READ
FILE-Q WELLHDR	RANDOM	READ/WRITE
FILE-Q UPDATEHDR	RANDOM	READ/WRITE
FILE-Q FRMTTMP	RANDOM	WRITE
TEMPER.FOR	FORMATTED	READ

Instructions for Operating TMPGEN

Copy the TMPMMDDYY.FOR file for the date wanted to DB1: example:

```
PDS>> PIP DB1:TEMPER.FOR=DB1:HYD031979.FOR
```

```
PDS>> RUN DB1:TMPGEN (CR)
```

```
ENTER FILE-Q DISC UNIT NUMBER (A2,I1) DB1:
```


APPENDIX C

DISPOSAL/WITHDRAWAL DATA BASE

APPENDIX C

DISPOSAL/WITHDRAWAL DATA BASE

INTRODUCTION

The disposal/withdrawal data base, FACIDB, is designed for storage and retrieval of volumetric flow rates being disposed (recharged) to and withdrawn (pumped or discharged) from the Hanford unconfined aquifer. The data can be entered as liters or gallons per month, and it is stored as cubic feet per day for use in ground-water flow models. FACIDB employs the TOTAL data base management system rather than the CIRMIS software.

Data Entry Programs

There are three programs designed for interactively entering new data, updating old data, and deleting old data from the data base. They are 1) ADDFAC, for disposal or withdrawal facility name and comments; 2) UPRATE, for flow rate, source of flow, month and year, units of rate, and comments; and 3) XYIN, for digitized latitude values along the facility perimeter. The user will be asked if 'CHANGES COMPLETE TO THIS RECORD' after inserting or updating a record. If the user does not answer "Y" then no change will be made to the data base. In this way if the user has made an error, and doesn't want to perform any action he/she does not answer "Y".

ADDFAC - Facility Description

ADDFAC is used to delete, insert, or update records on each facility (i.e., crib number or pumping well) in the data base. It is important to note that before the user can run one of the programs to add records to the data base, a facility record must be added. In other words, the user can not add a set of X,Y coordinates for B Pond until B Pond has been added using ADDFAC. Likewise, flow rate records can not be added to B Pond using UPRATE until it has been added using ADDFAC. On the other hand, a facility can not be deleted from the data base using ADDFAC until all the X,Y coordinates and rate records for that facility have been deleted. All programs are designed to warn the user about this type of mistake.

UPRATE - Flow Rates

UPRATE is used to delete, insert, or update the actual flow rate records. Pumping rates are entered as negative values. Each facility may have a number of flow rate records for a given month and year from different sources. Data that are retrieved will be a sum of all sources to that facility for a given month and year. UPRATE prompts the user for a date in the form MMDDYY, and since we are only concerned with the month and year, a day value of '01' should be used consistently (e.g., 020184 for February of 1984). Note that the default value for units is liters, so that if anything other than an 'L' or 'G' is entered, 'L' is assumed. To update or delete a rate record, the user will need to specify the facility, source, and date in order to single out exactly which record to delete. For more information on the formats of dates and numerical values when inputting the data, see Section IV, Guidelines for Interactive Updating. Comments may also be added for each flow rate record and should contain information such as reference for the data, inputs used in the water balance calculation (outside this data base) to arrive at the rate, and source description information.

XYIN - Location Coordinates

XYIN is used to delete or insert sets of X,Y coordinates in longitude and latitude for a given facility. The coordinates are entered in sets of 30 on the screen at a time. The user may use the back up character (see Section IV) to back up and correct a mistake, but only on the current screen of 30 coordinates. The user may not back up to a previous screen, so if a mistake is made, the entire set must be deleted, then added again. The program will catch mistakes such as letters inadvertently typed in place of numbers.

Data Viewing Programs

VALL

VALL is used to interactively view the flow rate records for a given facility and all the comments stored with that record. The facility record is displayed at the top of the screen. The flow rate records are viewed as one full screen at a time, in descending order of date, with the most recent records at the top of the screen. The program will pause when the screen is

full. The next screen can be viewed by hitting a carriage return and so on. The user can enter the 'stop' character (see Section IV) instead of a carriage return if no more data is desired.

VRATE

VRATE is used to look at the flow rate records for a specific facility, without the associated comments. It works identically to VALL.

T-ASK

T-ASK is the query language of the TOTAL system. A T-ASK procedure has been set up to view the flow rate data excluding comments. Reports in any format may be produced. The following procedure should be used to view the data as it is stored (in cubic feet per day). The UNITS data type only indicates the units of the input data (gallons or liters per month).

After logging into the PONDEV account on the PDP 11/70 computer and receiving the PDS>> prompt, type the following responses (underlined):

```
PDS>> ASK
ENTER ACCESS CODE: FACIDB
T-ASK> BUILD
SELECT DATA NAMES
          0 FACILITY          1 DATE
          2 VALUE             3 UNITS
          4 DESCRIPTION (of source)

0-4
ENTER SELECTION CRITERIA
FACILITY NE ' '
END (or GO to see data on the screen)
T-ASK> OUTPUT=filename (if data not viewed on screen)
T-ASK> GO
T-ASK> LOGOFF (to resume PDS>>)
```


Subroutines for Data Retrieval with User Written Programs

GETXY

GETXY is used to retrieve the set of X,Y coordinates stored for a given facility. It may be called from any program that supports a call statement (FORTRAN, Pascal, etc.). It is called with three (3) parameters:

- FACILITY - The 12 byte facility designation.
- ARRAY - An array of four byte Real numbers that is filled with coordinates by GETXY.
- NUMBER - An Integer variable in which GETXY returns the number of pairs of coordinates stored for that facility.

The user provides the facility name and GETXY will return the coordinates and number of pairs of coordinates. A call to GETXY in a FORTRAN program would look like: CALL GETXY(FACILITY,ARRAY,NUMBER). The coordinate values in the ARRAY are in the order X1, Y1, X2, Y2, etc. If the facility passed to GETXY does not exist in the data base then an error message will be typed on the users screen, and NUMBER will be 0. The user must make sure his/her array of real numbers is big enough to hold all the coordinates from the data base. (GETXY does not check to see if there are too many; it will return as many as it can and probably pick up some incorrect variables with the extra values.)

GETVAL

GETVAL is used to retrieve a flow rate (which is the sum of all sources for a facility) for a given month and year. It too may be called from any user written program. It uses four (4) parameters:

- FACILITY - The 12 byte facility designation.
- MONTH - An integer month.
- YEAR - An integer year (i.e. 84)
- VALUE - A four byte Real number which is the rate in cubic feet/day.

The user provides the facility, month, and year, and GETVAL will return the rate in VALUE. A call to GETVAL in a FORTRAN program might look like:
CALL GETVAL(FACILITY,MONTH,YEAR,VALUE).

If the facility passed to GETVAL does not exist in the data base, then an error message will be typed on the screen, and a VALUE of 0 is returned. If there is not a record present for the requested month and year, GETVAL will return a value of 0.

Library Required for Compiling Codes Using Subroutines

In order to use either of these two routines, the user must link with the library which contains them from the PONDEV directory. The library is called FACTOT. For example, linking this library to a program called TEST would require the command: LINK TEST,[356,7]FACTOT/LIB.

GUIDELINES FOR INTERACTIVE UPDATING

Use a carriage return to answer "no" or indicate no change to any question. Entering carriage returns (CR) will eventually get you out of most processing steps.

To stop any level of updating activity, enter a dollar sign (\$) or the special stop character ([) designated for this data base. Follow it with a carriage return. The dollar sign is particularly useful when you have updated all the fields in a record you wish to update. Some prompts can only be stopped by entering a dollar sign or the stop character, followed by a carriage return.

To remove an existing value and replace it with blanks or zero, enter an asterisk (*) and a carriage return. Entering blanks followed by a carriage return is the same as entering just a carriage return (i.e., no action is taken).

To back up to a previous field, enter a back slash (/) and a carriage return. Successive backslashes followed by carriage returns move you backwards through the fields so you can "pick up" a field for which you were previously prompted.

Numeric values can be entered in a variety of ways. Enter values left justified following the prompt. The program converts the number you input into the proper form for storage. Values using exponential notation (e.g., $-.123E+01$) can be entered using the decimal notation (-1.23). Enter numeric values in the manner easiest for you. The program will make sure it is stored in the proper form and will display it on the screen in the converted form. If you enter an invalid value (eg., the letter O instead of the digit zero), the program will tell you it is an incorrect value and prompt you again.

Enter dates without slashes in the form MMDDYY. The program will display the date with slashes to aid readability. The program checks the month and day to see if they are valid. If they are not, it will tell you the date is improper and prompt you again. No checks are currently made for valid years.

PROGRAM RATCHK FOR CHECKING INSERTED RATE VALUES

The program RATCHK is used to retrieve and list rate values from the data base to ensure correctness of inserted data. (The T-ASK program, described above, should be used to check source descriptions. Comments could be viewed with VALL.). The program prompts the user for the desired name of the output file, which should be no more than fifteen characters in length. The user is then prompted for the facility name exactly as it is stored in the data base. The user must then enter the units, gallons or liters, in which the data were originally entered. Next, the user is prompted to choose between retrieval of all historical values since January of 1950 or retrieval for a specified time period. The latter requires a starting month (as an integer) and a year, and both options require an ending month and year.

The program uses a CALL statement to the GETVAL subroutine from the FACTOT/LIB. GETVAL returns the values in cubic feet per day as they are stored in the data base. RATCHK converts the data to liters or gallons per month as requested earlier in the run. The data are written to the output file and echoed to the screen as the program runs. Large output files may be printed out for checking all values with raw data sheets. Note that the data returned

by GETVAL is a summation of all sources for that month and year for the facility. The program should not be run if sources for a given month and year were input with different units.

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